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WHY THIS BOOK NOW?

We titled this book *Figuring Out Fluency* because, as a nation, an education system, and as educators ourselves, we have truly been trying for decades to figure out what mathematical fluency *really* means and ensure that this is the focus of instruction in our classrooms. Fluency has long been interpreted as adeptly implementing algorithms, yet real fluency is a creative process in which a person is able to choose a strategy that makes sense for the numbers at hand. *Real* fluency, therefore, requires conceptual understanding of the operations, understanding properties, and having a repertoire of methods. Compare these two metacognitive thought processes when encountering a computational problem like this: $\frac{3}{4} \times 24$

Student A: What method am I supposed to use for these? Oh, it's multiplying fractions, so I put a 1 under the 24 and multiply the numerators and multiply the denominators.

Student B: How can I find three-fourths of 24? Shall I do it mentally? Use a written method (which one)? Oh, hey, I can do this mentally—one-fourth of 24 is 6, so three-fourths is 18.

The procedure explained by Student A continues to be the most common way in which students (and adults) go about doing mathematics. Students who complete problems accurately are misdeemed “fluent.” But *fluent* students would pursue the second line of thinking—noticing that they don't need the standard algorithm for this problem—and take the shortcut. Notice the lead-in lines here: *What method am I supposed to use ...* versus *How can I find ...* Teaching for fluency in mathematics (procedural fluency) focuses on the latter—helping students to become decision-makers, relying on their own thinking.

The field of mathematics education has come a long way in helping us accurately define procedural fluency and implement teaching that focuses on fluency. For example, *Adding It Up* (National Research Council, 2001) describes how dynamic procedural fluency really is:

Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. (p. 121)

Adding It Up also speaks to the definition of procedural fluency: “Not all computational situations are alike. For example, applying a standard pencil-and-paper algorithm to find the result of every multiplication problem is neither necessary nor efficient” (2001, p. 122).

Additionally, The National Council of Teachers of Mathematics' (NCTM) *Principles to Actions* (2014) explains how effective mathematics teaching can support procedural fluency in one of its Effective Mathematics Teaching Practices:

Build fluency from conceptual understanding: Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in *using procedures flexibly* as they solve contextual and mathematical problems. (p. 10; italics added)

So why do most students go about doing mathematics more like Student A rather than Student B? Here are a few possible reasons (the “we” refers to all of us in mathematics education, from textbook writers to teachers to policymakers):

- It is the way we learned and how we learned to teach.
- Procedural fluency and conceptual understanding are often seen as competing for attention, with “good” teaching attending to conceptual understanding.
- We misinterpret procedural fluency as a rigid mastery of algorithms (as the two metacognitive examples illustrate). Books and worksheets labeled as “fluency practice” are actually focused solely on mastery.
- We misinterpret phrases like “fluently multiply” to mean “use the standard algorithm.”
- We want students to know at least one method, but often fail to go further, which actually denies access to fluency.
- We worry about using different methods for fear it will make students struggle and/or cause parent concerns.

We hope this list doesn't come across as deficit thinking, but we want to preface this book by clearly communicating that characterizing fluency only as mastering algorithms is a deficit view on fluency. In truth, fluency is so much richer than that. Fluency has been grossly oversimplified and therefore undertaught. *Real* fluency in mathematics involves reasoning and creativity. It varies by situation. Having fluency empowers students—shaping their positive mathematical identities and developing their sense of mathematical agency. Importantly, evaluating students based on an oversimplified (and inaccurate) perception of fluency—saying they are “good” at math because they are fast, or worse, saying they are “bad” at math because they are not—is a deficit view of *students*. Instead, fluency efforts must ensure that all students have access to a range of strategies and have regular opportunities to choose among those strategies.

One other possible reason that students are still functioning from a mastery perspective rather than a fluency perspective is there just is not enough support for teachers to shift toward a fluency approach. While many fantastic books provide guidance on developing conceptual foundations, far fewer attend to procedural fluency (even though, as noted earlier, this word is on many rote practice books). And that is why we wrote this book: to illuminate the meaning of real fluency, to

help navigate the selection of strategies, and to provide a plethora of ideas to shift classroom practice toward a fluency approach.

WHO IS THIS BOOK FOR?

Our primary audience members are teachers and teacher leaders. These include novice and experienced K–8 teachers, mathematics coordinators, mathematics coaches, curriculum coordinators, mathematics teacher educators, professional development facilitators, and faculty in teacher preparation programs. Additionally, curriculum developers and policymakers who influence mathematics standards can benefit from the definitions created in this book and the many examples and activities.

WHAT WILL THIS BOOK DO FOR ME?

Our goal is that this book will give you the inspiration and the tools to think of fluency in a broader way and to value its importance alongside the conceptual understanding you have likely been working harder than ever to instill. In reading this book, you will

- Develop a deeper understanding of what procedural fluency is (and is not)
- Understand how to advantage students' understandings and skills to support their emerging fluency
- Learn which utilities, reasoning strategies, and automaticities to attend to in your teaching
- Have a robust collection of routines, games, and other activities that support a fluency agenda
- Develop techniques for assessing all components of fluency
- Be ready and excited to engage families in understanding and supporting fluency

ORGANIZATION

Figuring Out Fluency begins with figuring out what fluency means (Chapters 1 and 2). In the first chapter, we describe what fluency is (and why it is an equity issue), and in Chapter 2, we address the many fallacies that exist related to fluency. Many books attend to conceptual foundations for a particular type of number (e.g., fractions) or operation (addition and subtraction), with less attention to reaching procedural fluency. This book is the reverse. We condense the discussion of foundations to Chapter 3. Chapters 4 and 5 provide important lists for developing a fluency plan. Chapter 4 includes seven very useful strategies, which are useful across types of numbers—hence, we call them our Seven Significant Strategies. Chapter 5

identifies a list of procedures beyond the basic facts for which automaticity should be the goal. For example, being automatic with knowing combinations that equal 100 supports reasoning strategies. Ensuring every student develops these strategies and skills requires high-quality practice, the focus of Chapter 6. Chapter 7 provides a wide array of methods for assessing real fluency (attending to strategies, flexibility, and so on). With the confusion around what fluency really means, communicating with families is essential—and the focus of Chapter 8. We close with attention to planning in Chapter 9—putting all these pieces together so that you and your school/district will produce students who truly are fluent in mathematics.

Like developing fluency, teaching for fluency takes time and practice! There are many *teaching* strategies to consider—many issues to figure out. This book includes several features to support this “figuring out”:

1. **Activities.** Thirty-six activities, including many routines and games, are integrated into the chapters. They focus on the often neglected components of fluency (strategy selection and flexibility), reasonableness, and connecting concepts to procedures.
2. **Stop & Reflect prompts throughout the chapters.** If you are reading alone, pause and think through these questions; if you are reading with others, stop and share at these points.
3. **Teaching Takeaways** are included in every chapter to highlight bold ideas to pay special attention to.
4. **Talk About It** questions are offered at the end of every chapter to revisit ideas proposed in the chapter. These can serve to guide book study discussions, as well as to help you process what you have read so that you can distill what you want to take away from the chapter.
5. **Act On It** suggestions follow the Talk About It section at the end of each chapter. Figuring out fluency requires taking action! Consider these a menu of ideas of how to get started. If you are able to use this book at the school level, these activities can be part of a faculty meeting or professional learning experience.
6. **Resources** are available online through the *Figuring Out Fluency* companion website to support your efforts. Each resource in the book that is also available for download is noted with the prompt: This resource can be downloaded at resources.corwin.com/figuringoutfluency.

And to help you continue to figure out fluency for specific content areas, this anchor book is complemented by **five Classroom Companion books**. These books elaborate on the pragmatic teaching ideas and activities in this anchor book and provide even more instructional and practice activities for use in the classroom. Working

with a fantastic author team, Sherri Martinie, Rosalba McFadden, Jennifer Suh, and C. David Walters, the full set of *Figuring Out Fluency* will include these titles:

Figuring Out Fluency: Addition and Subtraction With Whole Numbers

Figuring Out Fluency: Multiplication and Division With Whole Numbers

Figuring Out Fluency: Addition and Subtraction With Fractions and Decimals

Figuring Out Fluency: Multiplication and Division With Fractions and Decimals

Figuring Out Fluency: Operations With Real Numbers and Algebraic Expressions

As we began this Preface, so we close. We have spent decades trying to figure out fluency. We are still on that journey. Our best thinking is shared in this book, and we welcome opportunities to continue the journey with you.